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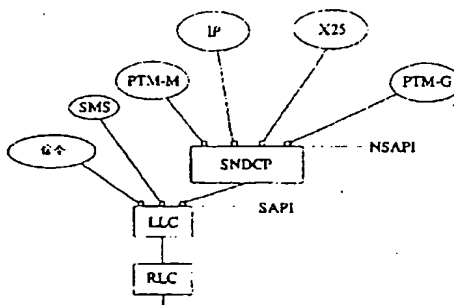
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权利要求书 1 页 说明书 7 页 附图页数 3 页

[54]发明名称 点对多点移动无线传输

[57]摘要

一种操纵移动通信系统的方法,该系统支持包括点对多点—多投(PTM-M)协议的在许许多个不同包数据协议(PDP)之下,在一个移动站(MS)和一个网络之间的数据传输。PDP 数据由一个子网络从属收敛协议(SNDCP)按数据的 PDP 进行格式化与去格式化。由一个在网络和移动站之间传送的协议标识符将 PDP 识别给 SNDCP。为了使 MS 能够在 IDLE 状态下接收 PTM-M,一个唯一的协议标识符被恒定地分配给 PTM-M 传输而其它的标识符由网络动态地分配给其它的 PDP。



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## 权 利 要 求 书

1. 一种操纵移动通信系统的方法, 该系统支持包括点对点多投 (PTM-M) 协议的在许多不同包数据协议 (PDP) 之下, 在一个移动站 (MS) 和一个网络之间的无线电数据传输, 其中协议由在网络和移动站之间传送的一个协议标识符来识别, 本方法包括恒定地分配一个唯一的协议标识符给 PTM-M 传输和动态地分配其它的标识符给其它的协议。

2. 如权利要求 1 的方法, 其中此方法组成通用包无线服务 (GPRS) 的部分。

3. 如权利要求 2 的方法, 其中数据被按子网络从属收敛协议 (SNDCP) 格式化供传输, 将数据格式化为许多不同包数据协议 (PDP) 中的一种供通过系统传输, 反过来用于接收数据也一样, SNDCP 处理 SNDCP 单元中的数据, 每个单元包含一个网络服务访问点标识符 (NSAPI), 识别使用中的 PDP 给 SNDCP, NSAPI 提供所述的协议标识符。

4. 如权利要求 2 的方法, 其中用于发送与接收的数据由 SNDCP 层以下的一个逻辑链路控制 (LLC) 层进行格式化, LLC 格式化包括使用一个服务访问点标识符 (SAPI) 识别 LLC 层的网络侧和用户侧上的服务访问点并且 SAPI 提供所述的协议标识符。

5. 被安排来实现权利要求 1 到 4 中任一项的方法的设备。

6. 安排来支持权利要求 1 到 4 中任一项的方法的移动通信设备, 该设备包括一个存储器, 其中存储被恒定地分配的 PTM-M 协议标识符, 和信号处理装置, 用于确定何时来自网络的传输包含所述的 PTM-M 协议标识符并用于顺序地接收和处理所述的传输。

# 说明书

## 点对多点移动无线传输

5 本发明涉及点对多点无线传输，并特别，虽非必须，适用于推荐给移动无线电通信的通用包无线服务（GPRS）无线电协议。

流行的数字蜂窝电话系统，例如 GSM（全球移动通信系统）的设计是着重话音通信。数据通常利用所谓的电路切换传输模式在空中接口上在一个移动站（MS）和一个基站子系统（BSS）之间传输，其中一个物理信道，即，在一个或多个频率上的一系列均匀间隔的时隙在  
10 呼叫持续时间内被保留。对于话音通信来说，要传输的信息流是比较连贯的，电路切换传输模式从情理上是有效率的。然而，在数据呼叫期间，例如 Internet 访问，数据流是“脉冲串式”的，在电路切换模式中长时间保留一个物理信道显得是对一种空中接口的不经济利用。

15 对数字蜂窝电话系统数据服务的需要增长迅速，一种新的基于 GSM 的服务，称为通用包无线服务（GPRS）目前已由欧洲远程通信标准研究所（ETSI）进行标准化并被规定在 GSM 03.60 的总栏目中。GPRS 为数据传输提供动态分配的物理信道。这就是说，只有当有数据要传输时才分配一个物理信道给一个特定的 MS 至 BSS 通信线路。避免了  
20 没有数据要传输时不必要的物理信道保留。

GPRS 被指望与常规的 GSM 电路切换传输一同工作以便让数据和话音通信有效地利用空中接口。因而 GPRS 利用为 GSM 规定的基本信道结构。在 GSM 中，一个给定的频段在时间域上被划分成一个接一个的帧，称为 TDMA（时分多址）帧。TDMA 帧的长度是 4.615ms。每个  
25 TDMA 帧被依次划分为 8 个相继的等持续时间的时隙。在常规的电路切换传输模式中，当一个呼叫被启动时，通过在每个相继的 TDMA 帧中保留一个给定的时隙（1 至 8）为该呼叫规定一个物理信道。在一个物理信道上一连 4 个相继的时隙被称为一个无线电块，代表在一个物理信道上用于包交换数据的最短传输单位。物理信道同样地被规定用  
30 于传递信号信息。随着 GPRS 的引入，物理信道将被动态地分配给切换的电路传输模式或包交换传输模式。当对于切换电路传输模式的网络需求比较高时，可为此模式保留大量的物理信道。否则，当对于 GPRS

传输的需求比较高时，大量的物理信道可为此模式保留。另外，通过分配每个相继的 TDMA 帧中两个或多个时隙给一个单独的 MS 可提供一个高速包交换传输信道。

5 用于 GSM Phase 2 (GSM 04. 65) 的 GPRS 无线电接口可被设计成具有如图 1 所示的特定功能逻辑层的分层结构，其中移动站 (MS) 和网络具有通过 MS/网络接口 Um 通信的相同的层次。每层将从相邻层接收到的数据格式化，接收数据从底层到顶层，传输数据从顶层到底层。

10 在顶层是许多包数据协议 (PDP)。这些 PDP 中的某些是点对点协议 (PTP)，适合于发送包数据从一个 MS 到另一个 MS，或者从一个 MS 到一个固定的终端。PTP 协议的例子是 IP (Internet 访问协议) 和 X. 25。所有的 PDP 利用一种公共子网络从属收敛协议 (SND CP)，正如其名字所启示的，将不同的 PDP 变换 (或 '收敛') 为一种适合于以一种透明方式作进一步处理的公共形式 (由 SND CP 单元组成)。  
15 这种结构意味着将来新开发的 PDP 可很容易并入现有的 GPRS 结构体系中。

SND CP 规定用户数据的多路复用和分割、数据压缩、TCP/TP 头压缩，以及依据所要求的服务质量的传输。SND CP 单元有大约 1600 个八位字节并包括一个地址区，包含一个网络服务访问点标识符  
20 (NSAPI)，用于识别末端的连接，例如 IP，X. 25。每个 MS 可分配到一组与其它 MS 无关的 NSAP。

在顶层也有其它的 GPRS 末端协议，例如 SMS 和信令 (L3M)。每个 SND CP (或其它的 GPRS 末端协议) 单元由在无线电接口上的一个逻辑链路控制 (LLC) 帧携带。LLC 帧系统阐述在 LLC 层 (GSM 04. 64)  
25 中并包括有编号和临时寻址区，可变长度信息区，和帧检查序列的头帧。更具体而言，寻址区包括一个服务访问点标识符 (SAPI)，用于识别在 LLC 接口网络侧和用户侧上的特定连接末端 (及其有关的优先权和服务质量 (QOS))。一个连接末端是 SND CP。其它的末端包括短消息服务 (SMS) 和管理层 (L3M)。LLC 层为这些不同的末端协议提供  
30 一个收敛协议。SAPI 的分配是恒定的并且对所有的 MS 是公共的。

无线链路控制 (RLC) 层特别规定将逻辑链路控制层 PDU (LLC - PDU) 分割并重新组装到 RLC 数据块中的步骤，和重新传输未成功地

发送的 RLC 块的步骤。媒介访问控制 (MAC) 层在物理链路层 (见下面) 之上工作并规定使多个 MS 能够共享一个公共传输媒介的步骤。MAC 的功能是在多个试图同时发送的 MS 之间进行仲裁, 并提供避免冲突、检测和复原的步骤。

- 5       物理链路层 (Phys. Link) 提供 MS 和网络之间的物理信道。物理射频层 (Phys. RF) 特别规定载频和 GSM 无线电信道结构, GSM 信道的调制, 以及发射机/接收机特性。

- 对于 GPRS 传输, 规定了三种不同的可变动的管理状态: IDLE, STANDBY, 和 READY. IDLE 状态的 MS 并不“依附”GPRS, 所以网络并不知道这个 MS. 然而, MS 一直在收听广播控制消息, 例如, 确定网络蜂窝选择。STANDBY 状态的 MS 是依附 GPRS 的, 并且它的位置 (路由区域) 由网络跟踪。然而, 并没有数据被传送。当在发送数据并在其后的几秒时间内, MS 处于 READY 状态。因此 READY 状态的 MS 也被网络跟踪。正如当前提议的, 有 16 个唯一的 NSAPI 码可用于识别 PDP。NSAPI 码是由网络动态地分配的, 所以 MS 必须或者处于 STANDBY 状态或者处于 READY 状态以便知道所分配的码。正如当前提议的, IDLE 状态的 MS 不可能在任何 PDP 中接收传输信号。对于 PDP, 例如 IP 和 X. 25, 这不可能出现问题, 因为当这样的传输发生时, MS 将始终处于或者是 STANDBY 或者是 READY 状态中。
- 10       除了 PTP 以外, 有可能将来推出 GSM 时会规定其它的 PDP 并且特别是点对多点 (PTM) 的传送, 其中数据被传送到一组 MS (PTM-G, 点对多点-组呼叫) 或者传送到一个区域中所有的移动站 (PTM-M, 点对多点-多投)。这样一些 PDP 的使用包括操作者通报, 广告, 和特定的信息传送, 例如足球赛结果, 新闻等。就 MS 必须处于或者
- 15       STANDBY 或者 READY 状态中接收传输信号来说, PTP-G 是与 PTP 类似的。然而, 由于需要 (在 GSM 03.60 中规定) 一个 MS 在所有状态 (包括 IDLE 状态) 中接收 PTM-M 传输信号, 这样随着 PTM-M 出现了一个至今尚未认识到的问题。因为当一个 MS 处于 IDLE 状态时并没有 PDP 的内容起作用, 并且由网络分配的 NSAPI 码是动态的, 一个 IDLE 的
- 20       MS 不可能分配正确的 NSAPI 码给 PTM-M, 因而不可能接收 PTM-M。

- 虽然以上 GPRS 的讨论一直涉及 GSM, 但应注意, GPRS 具有更广泛的可应用性。例如, 通过只改变低级别的无线电协议, GPRS 可适用

于所提议的第三代标准 UMTS(Universal Mobile Telecommunication System)。

本发明的一个目的是克服以上提到的问题。尤其是，本发明的一个目的是使一个移动站在 MS 即使处于 IDLE 状态时也能接收 PTM-M。

5 依据本发明的第一方面，在此提供一种操作移动通信系统的方法，该系统支持在多种不同包数据协议(PDP)，包括点对多点-多投(PTM-M)协议下进行移动站(MS)和网络之间的无线电数据传输，其中协议是由网络 and 移动站之间传送的协议标识符来识别，该方法包括恒定地分配一个唯一的协议标识符给 PTM-M 传输并动态地分配其  
10 它标识符给其它的包数据协议。

最好，数据按子网络从属收敛协议(SNDCP)格式化供传输。SNDCP 将数据格式化为多种不同包数据协议(PDP)之一，用于通过系统传输，反过来用于接收数据也一样。SNDCP 将数据处理成 SNDCP 单元，其中每个包含对于 SNDCP 的网络服务访问点标识符(NSAPI)，识别  
15 使用中的 PDP-NSAPI 可以提供所述的协议标识符。典型情况下，NSAPI 具有 0 到 15 中的一个值，并且这些值中的一个被恒定地分配给 PTM-M。

用于发送和接收的数据可由 SNDCP 层以下的逻辑链路控制(LLC)层进行格式化。LLC 格式化包括使用服务访问点标识符(SAPI)来识别 LLC 层的网络侧和用户侧上的服务访问点。SAPI 可以提供所述的协议标识符。  
20

本发明特别适用于如为 GSM 网络所规定的 GPRS。然而，也可用于其它系统如用于 UMTS 的 GPRS。

25 依据本发明的第二方面，在此提供用于实施以上的本发明第一方面的方法的设备。

依据本发明的第三方面，在此提供一种移动通信设备，被安排成支持以上的本发明第一方面的方法，该设备包括一个存储器，在其中存储被恒定地分配的 PTM-M 协议标识符，和信号处理装置，用于确定何时来自网络的传输包含所述的 PTM-M 协议标识符并用于顺序地  
30 接收并处理所述的传输。

以上本发明的第三方面的实施方案包括移动蜂窝电话和组合的移动电话/个人数字助手设备。

为了更好地理解本发明并示出如何使其实施，将通过举例的方法参考以下附图来进行，其中：

图 1 示出图 1 网络 GPRS 无线链路的协议层；

图 2 简要地示出 GSM/GPRS 数字蜂窝电话网络的结构体系；

5 图 3 更详细地示出图 1 协议的上部层；和

图 4 示出对图 3 中所示结构体系的修改。

图 2 中示出支持 GPRS 的一种 GSM 蜂窝网的基本‘结构’。在图 2 中所用的术语是按常规定义在以下给出的清单中的。在本描述中使用的其它项也被定义了。

10 GPRS 协议层的一般结构体系已参考图 1 在上面描述了。本发明主要涉及这种结构体系的上面几层，如 RLC，LLC 和层 3 实体分开表示在图 2 中。所示的层 3 实体是信令，SMS，和包数据协议 IP 与 X.25(两种 PTP)，PTM-G，和 PTM-M。

15 LLC 层将数据格式化为 LLC 帧，每个包含一个数据链路连接标识符 (DLCI)，按次包含一个 SAPI (其值为从 0 到 15)。正如以上已经描述过的那样，SAPI 识别 LLC 层的网络侧和用户侧上的服务访问点。SAPI 具有预先规定的，对于网络 and 正在收听的 MS 是已知的值，所以即使在 IDLE 状态下 LLC 层也能正确地按规定路线传送接收到的传输。例如考虑一次传输由一个 MS 接收到的情况。LLC 层根据 SAPI  
20 选择正确的服务访问点，即信令，SMS，或 SND CP。

在 SAPI 识别 SND CP 的情况下，数据依据 SND CP 进行处理。每个 SND CP 数据单元依次包含一个 NSAPI，识别被使用的特定的 PDP，即 IP，X.25，PTM-G，或 PTM-M。NSAPI 可具有从 0 到 15 的一个值，用四位二进制码表示。与被恒定地分配的 SAPI 不同，对于 IP，X.25，  
25 和 PTM-G 的 NSAPI 是由网络动态地分配的。由信号消息通知 MS 此动态的分配。然而，它们只有处于或者 STANDBY 或者 READY 状态中的 MS 才接收到。

一个 NSAPI 被恒定地分配给 PTM-M PDP，这对于 MS 和网络是已知的。因为随着 SAPI，此 PTM-M NSAPI 被预存在 MS 的存储器中。  
30 在 MS 处于 IDLE 状态的情况下，接收到的 SND CP 单元被按规定路线从 LLC 层传送到 SND CP，此单元的 NSAPI 被读出以确定是否它与 PTM-M NSAPI 对应。如果是的，则 SND CP 相应地处理此单元并采用此 PTM-M

PDP. 如果 NSAPI 并不与 PTM-M NSAPI 对应, 则不进行进一步的处理, 因为所用的 PDP 不可能被识别。

图 4 示出对示于图 3 中的协议结构的修改. 这是依据未通过 SNDCP 层传送的 PTM-M 传输. 更确切地说, 这些传输是直接从 LLC 层传送到 PT-M 层. 在这种情况下, 一次 PTM-M 传输可通过恒定地分配一个 SAPI 到 PTM-M 传输来加以识别。

BSC 基站控制器

BSS 基站子系统

BTS 基本发送接收机站

GGSN 入口 GPRS 支持节点

GPRS 通用包无线服务

GSM 全球移动通信系统

HLR 内部位置寄存器

IP 互联网协议

L3M 层 3 管理

LLC 逻辑链路控制

MAC 媒介访问控制

MS 移动站

MSC 移动交换中心

NSAPI 网络服务访问点标识符

PC/PDA 个人计算机/个人数据助手

PDP 包数据协议

PDU 包数据单元

PSTN 公共交换电话网

PTM-G 点对多点组

PTM-M 点对多点多投

PTP 点对点

RLC 无线链路控制

SAPI 服务访问点标识符

SGSN 服务 GPRS 支持节点

SMS 短消息服务

SNDCP 子网络从属收敛协议



SS7 信令系统号 7

TCP/IP 传输控制协议/互联网协议

TDMA 时分多址

Um 移动站到网络接口

5 UMTS 通用移动远程通信服务

X.25 网络层协议技术说明

10

# 说明书附图

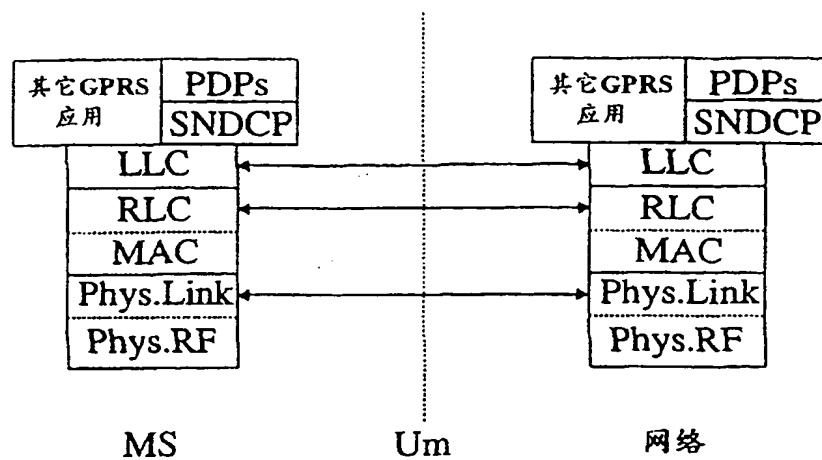


图 1

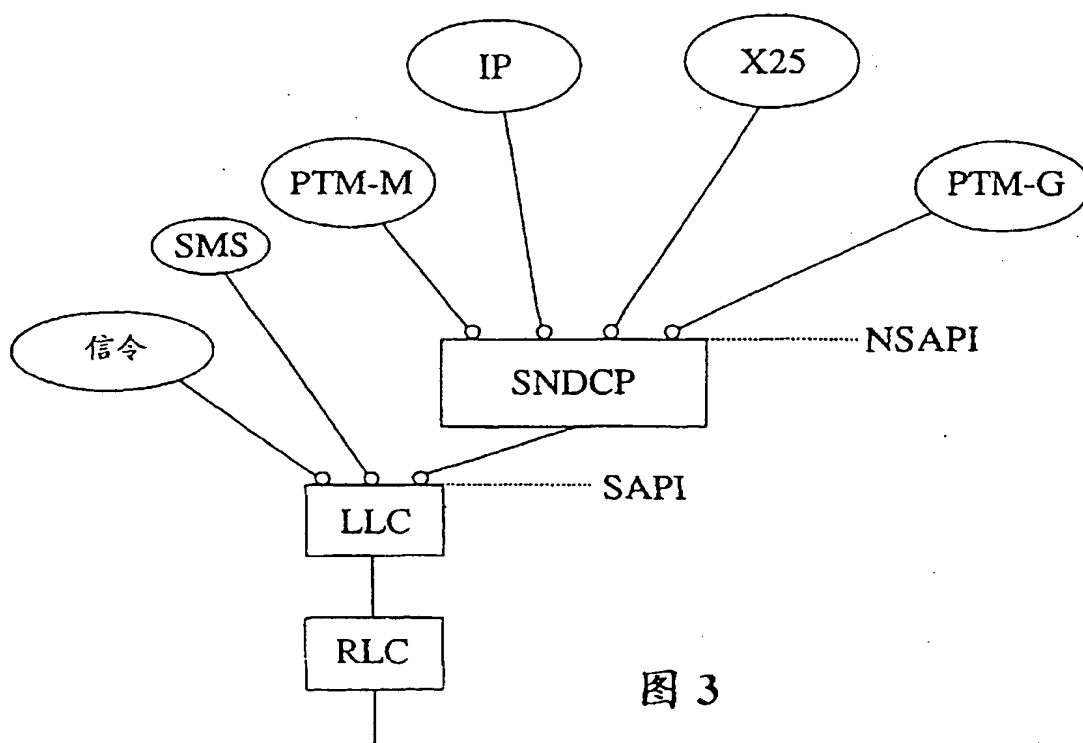


图 3

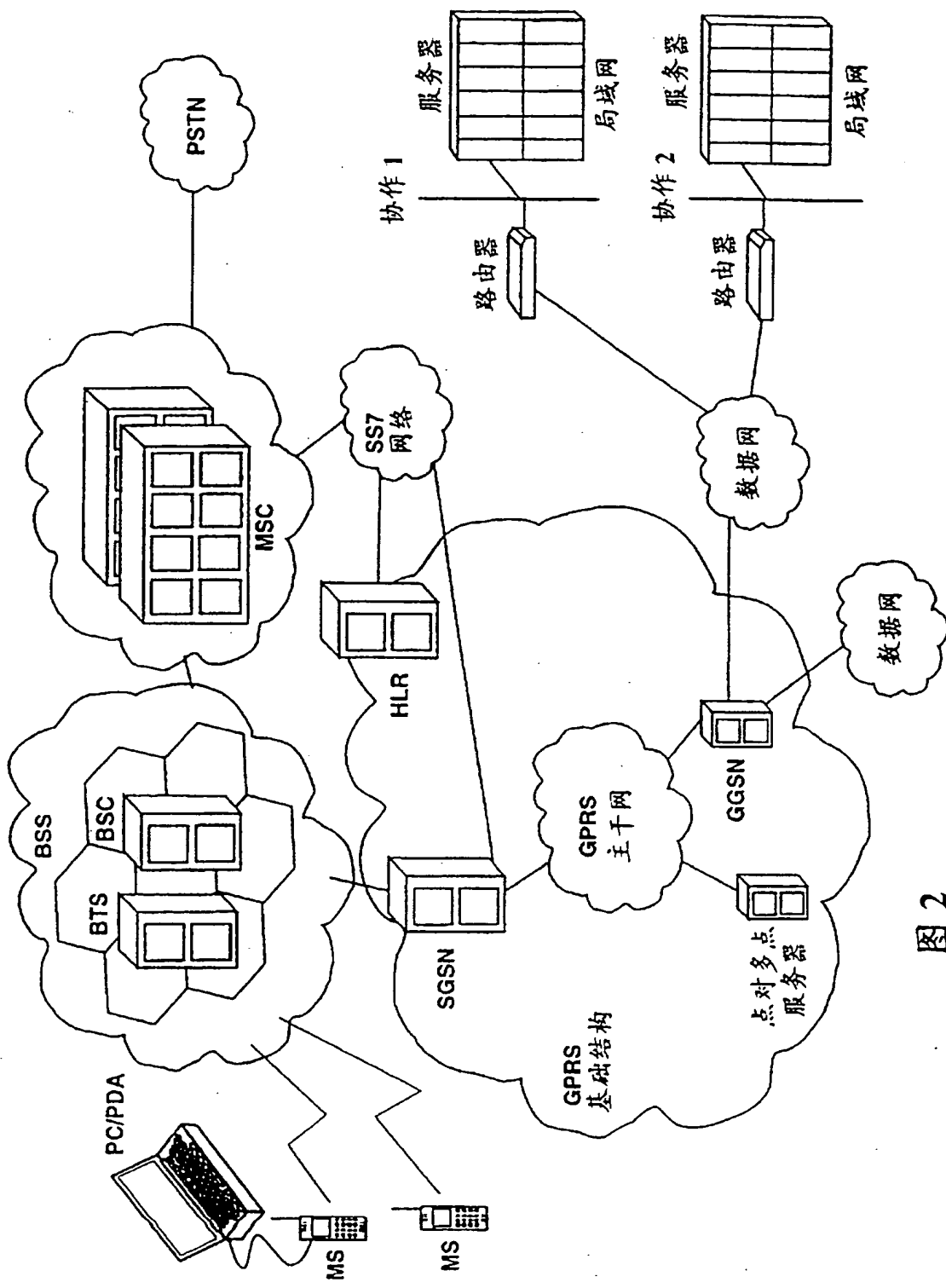


图 2

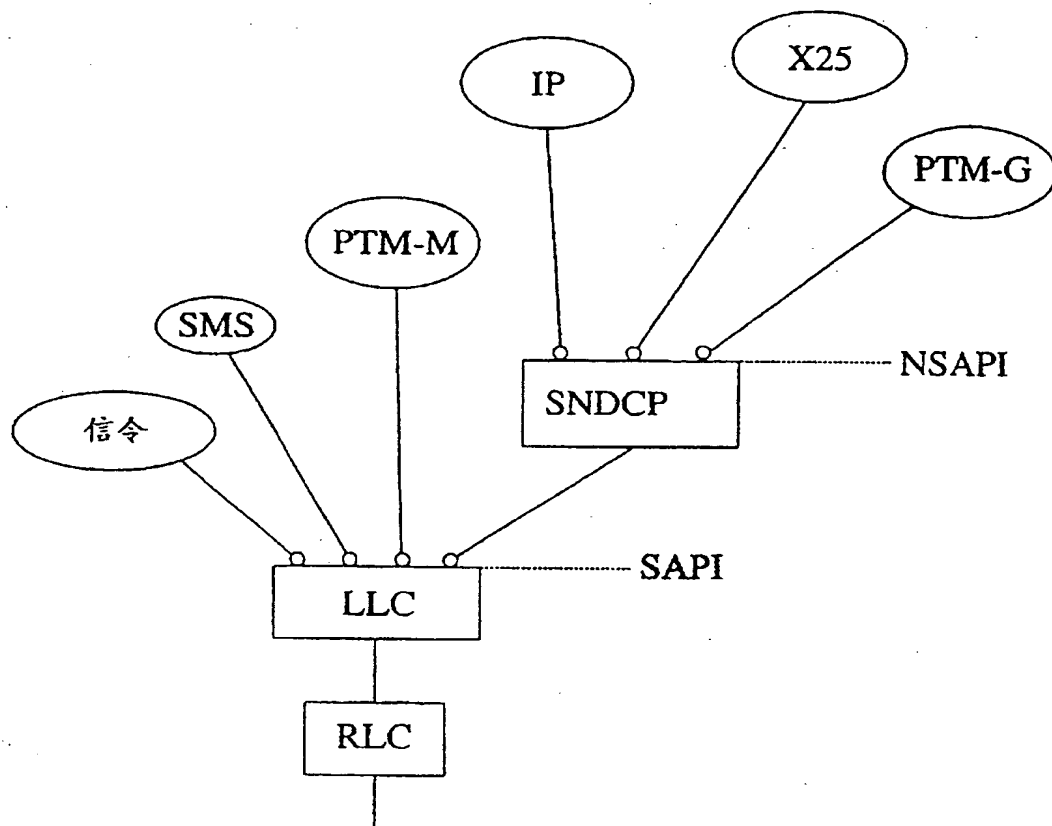


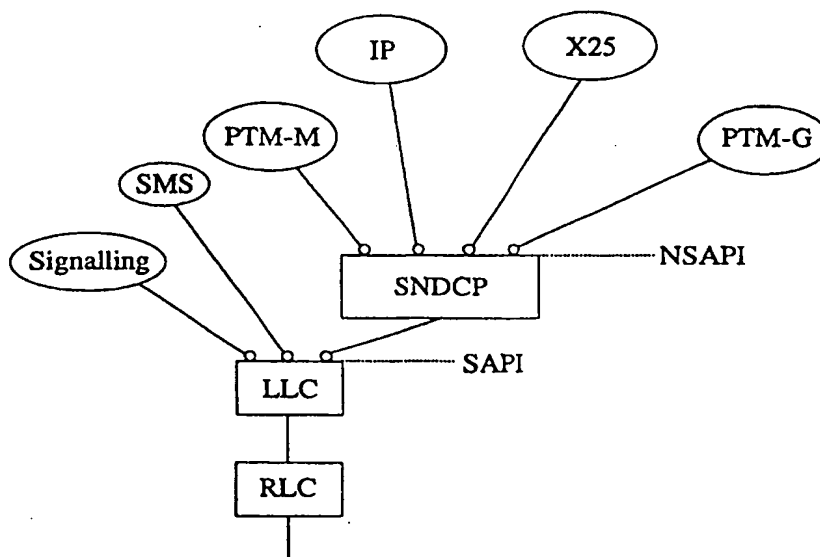
图 4



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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			(43) International Publication Date: 18 February 1999 (18.02.99)
(21) International Application Number: PCT/FI98/00511 (22) International Filing Date: 12 June 1998 (12.06.98) (30) Priority Data: 973303                      12 August 1997 (12.08.97)                      FI (71) Applicant (for all designated States except US): NOKIA MOBILE PHONES LTD. [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): LEPPISAARI, Arto [FI/FI]; Satakunnankatu 5 A 25, FIN-33100 Tampere (FI). HÄMÄLÄINEN, Jari [FI/FI]; Nallekarhentie 20, FIN-36100 Kangasala As. (FI). (74) Agent: JOHANSSON, Folke; Nokia Mobile Phones Ltd., P.O. Box 100, FIN-00045 Nokia Group (FI).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  Published Without international search report and to be republished upon receipt of that report.	

(54) Title: POINT-TO-MULTIPOINT MOBILE RADIO TRANSMISSION



## (57) Abstract

A method of operating a mobile communication system supporting data transmission between a mobile station (MS) and a network in a number of different packet data protocols (PDPs) including a point-to-multipoint-multicast (PTM-M) protocol. PDP data is formatted and unformatted by a subnetwork dependent convergence protocol (SNDCP) according to the PDP of data. The PDP is identified to the SNDCP by a protocol identifier transmitted between the network and the mobile station. In order to allow a MS to receive a PTM-M in an IDLE state, a unique protocol identifier is permanently assigned to PTM-M transmissions whilst other identifiers are dynamically assigned to other PDPs by the network.

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## Point-to-multipoint mobile radio transmission

The present invention relates to point-to-multipoint radio transmission and is applicable in particular, though not necessarily, to the General Packet Radio Service (GPRS) radio protocol proposed for mobile radio communications.

Current digital cellular telephone systems such as GSM (Global System for Mobile communications) were designed with an emphasis on voice communications. Data is normally transmitted between a mobile station (MS) and a base station subsystem (BSS) over the air interface using the so called circuit switched transmission mode where a physical channel, i.e. a series of regularly spaced time slots on one or more frequencies, is reserved for the duration of the call. For voice communications, where the stream of information to be transmitted is relatively continuous, the circuit switched transmission mode is reasonably efficient. However, during data calls, e.g. internet access, the data stream is 'bursty' and the long term reservation of a physical channel in the circuit switched mode represents an uneconomic use of the air interface.

Given that the demand for data services with digital cellular telephone systems is increasing rapidly, a new GSM based service known as the General Packet Radio Service (GPRS) is currently being standardised by the European Telecommunications Standards Institute (ETSI) and is defined in overall terms in GSM 03.60. GPRS provides for the dynamic allocation of physical channels for data transmission. That is to say that a physical channel is allocated to a particular MS to BSS link only when there is data to be transmitted. The unnecessary reservation of physical channels when there is no data to be transmitted is avoided.

GPRS is intended to operate in conjunction with conventional GSM circuit switched transmission to efficiently use the air interface for both data and voice communications. GPRS will therefore use the basic channel structure defined for GSM. In GSM, a given frequency band is divided in the time domain into a succession of frames, known as TDMA (Time Division Multiplexed Access) frames. The length of TDMA frame is 4.615ms. Each TDMA frame is in turn divided into eight consecutive slots of equal duration. In the conventional circuit switched transmission mode, when a call is

initiated, a physical channel is defined for that call by reserving a given time slot (1 to 8) in each of a succession of TDMA frames. A series of four consecutive time slots on a physical channel is known as a radio block and represents the shortest transmission unit for packet switched data on a physical channel. Physical channels are similarly defined for conveying signalling information. With the introduction of GPRS, physical channels will be dynamically assigned for either switched circuit transmission mode or for packet switched transmission mode. When the network requirement for switched circuit transmission mode is high, a large number of physical channels may be reserved for that mode. On the other hand, when demand for GPRS transmission is high, a large number of physical channels may be reserved for that mode. In addition, a high speed packet switched transmission channel may be provided by assigning two or more slots in each of a succession of TDMA frames to a single MS.

The GPRS radio interface for GSM Phase 2+ (GSM 04.65) can be modelled as a hierarchy of logical layers with specific functions as shown in Figure 1, where the mobile station (MS) and the network have identical layers which communicate via the MS/network interface Um. Each layer formats data received from the neighbouring layer, with received data passing from the bottom to the top layer and data for transmission passing from the top to the bottom layer.

At the top layer are a number of packet data protocols (PDPs). Certain of these PDPs are point-to-point protocols (PTPs) adapted for sending packet data from one MS to another MS, or from one MS to a fixed terminal. Examples of PTP protocols are IP (internet access protocol) and X.25. The PDPs all use a common subnetwork dependent convergence protocol (SND CP) which, as its name suggests, translates (or 'converges') the different PDPs into a common form (composed of SND CP units) suitable for further processing in a transparent way. This architecture means that new PDPs may be developed in the future which can be readily incorporated into the existing GPRS architecture.

The SND CP defines multiplexing and segmentation of user data, data compression, TCP/IP header compression, as well as transmission according to the requested quality of service. SND CP units are about 1600 octets and comprise an address field which



contains a network service access point identifier (NSAPI) which is used to identify the endpoint connection, e.g. IP, X.25. Each MS may be assigned a set of NSAPIs independently of the other MSs.

Also on the top layer are other GPRS end point protocols such as SMS and signalling (L3M). Each SNDCP (or other GPRS end point protocol) unit is carried by one logical link control (LLC) frame over the radio interface. The LLC frames are formulated in the LLC layer (GSM 04.64) and include a header frame with numbering and temporary addressing fields, a variable length information field, and a frame check sequence. More particularly, the addressing fields include a service access point identifier (SAPI) which is used to identify a specific connection endpoint (and its relative priority and Quality of Service (QoS)) on the network side and the user side of the LLC interface. One connection endpoint is the SNDCP. Other endpoints include the short message service (SMS) and management layer (L3M). The LLC layer provides a convergence protocol for these different endpoint protocols. SAPIs are allocated permanently and are common to all MSs.

The Radio Link Control (RLC) layer defines amongst other things the procedures for segmenting and re-assembling Logical Link Control layer PDUs (LLC-PDU) into RLC Data Blocks, and for retransmission of unsuccessfully delivered RLC blocks. The Medium Access Control (MAC) layer operates above the Phys. Link layer (see below) and defines the procedures that enable multiple MSs to share a common transmission medium. The MAC function arbitrates between multiple MSs attempting to transmit simultaneously and provides collision avoidance, detection and recovery procedures.

The physical link layer (Phys. Link) provides a physical channel between the MS and the network). The physical RF layer (Phys. RF) specifies amongst other things the carrier frequencies and GSM radio channel structures, modulation of the GSM channels, and transmitter/receiver characteristics.

For GPRS transmission, three different mobility management states are defined: IDLE, STANDBY, and READY. An IDLE state MS is not GPRS 'attached' and so the network is not aware of this MS. However, the MS is listening to broadcast control messages,

for example, to determine network cell selection. A STANDBY state MS is GPRS attached and its location (routing area) is tracked by the network. However, there is no data being transmitted. A MS is in a READY state when it is transmitting data and for a short while after. A READY state MS is therefore also tracked by the network. As currently proposed, there are 16 unique NSAPI codes available for identifying PDPs. The NSAPI codes are assigned dynamically by the network so that a MS must be in either the STANDBY state or the READY state to be aware of the allocated codes. As currently proposed, an IDLE state MS cannot receive transmissions in any PDP. For PDPs such as IP and X.25 this does not present a problem as the MS will always be in either the STANDBY or READY state when such transmissions are taking place.

In addition to PTPs, it is likely that future releases of GSM will specify other PDPs and in particular point-to-multipoint (PTM) transfer where data is transmitted to a group of MSs (PTM-G, point-to-multipoint-groupcall) or to all mobiles in an area (PTM-M, point-to-multipoint-multicast). The uses of such PDPs include operator announcements, advertisements, and specific information transfer such as football results, news etc. PTP-G is similar to PTP in so far as a MS must be in either the STANDBY or READY state to receive a transmission. However, a hitherto unrecognised problem arises with PTM-M due to the need (defined in GSM 03.60) for a MS to receive PTM-M transmissions in all states including the IDLE state. As no PDP contexts are active when a MS is in the IDLE state, and the allocation of NSAPI codes by the network is dynamic, an IDLE MS cannot allocate the correct NSAPI code to a PTM-M and therefore cannot receive a PTM-M.

Whilst the above discussion of GPRS has been concerned with GSM, it is noted that GPRS has a much wider applicability. For example, by changing only the low level radio protocol, GPRS may be adapted to the proposed third generation standard UMTS (Universal Mobile Telecommunication System)

It is an object of the present invention to overcome the problem noted above. In particular, it is an object of the present invention to enable a mobile station to receive a PTM-M even when the MS is in an IDLE state.

According to a first aspect of the present invention there is provided a method of operating a mobile communication system supporting radio data transmission between a mobile station (MS) and a network in a number of different packet data protocols (PDPs) including a point-to-multipoint-multicast (PTM-M) protocol, where the protocol is identified by a protocol identifier transmitted between the network and the mobile station, the method comprising permanently allocating a unique protocol identifier to PTM-M transmissions and dynamically allocating other identifiers to other packet data protocols.

Preferably, data is formatted for transmission according to a subnetwork dependent convergence protocol (SND CP). The SND CP formats data, in one of a plurality of different packet data protocols (PDP), for transmission via the system and *vice versa* for received data. The SND CP processes data in SND CP units, each of which contains a network service access point identifier (NSAPI) which identifies the PDP in use, to the SND CP. The NSAPI may provide said protocol identifier. Typically the NSAPI has a value of 0 to 15 and it is one of these values which is permanently assigned to PTM-M.

Data for transmission and reception may be formatted by a logical link control (LLC) layer below an SND CP layer. LLC formatting includes the use of a service access point identifier (SAPI) to identify the service access point on the network side and on the user side of the LLC layer. The SAPI may provide said protocol identifier.

The present invention is applicable in particular to GPRS as specified for GSM networks. However, it may also be applied to other systems such as GPRS for UMTS.

According to a second aspect of the present invention there is provided apparatus for implementing the method of the above first aspect of the present invention.

According to a third aspect of the present invention there is provided a mobile communication device arranged to support the method of the above first aspect of the present invention, the device comprising a memory in which is stored the permanently allocated PTM-M protocol identifier, and signal processing means for determining when

a transmission from the network contains said PTM-M protocol identifier and for consequently receiving and processing said transmission.

Embodiments of the above third aspect of the present invention include mobile cellular telephones and combined mobile telephone/personal digital assistant devices.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates the protocol layers of a GPRS radio link of the network of Figure 1;

Figure 2 shows schematically the architecture of a GSM/GPRS digital cellular telephone network;

Figure 3 illustrates in more detail the upper layers of the protocol of Figure 1; and

Figure 4 illustrates a modification to the architecture shown in Figure 3.

There is illustrated in Figure 2 the basic 'architecture' of a GSM cellular network which supports GPRS. The terminology used in Figure 2 is defined, by convention, in the list given below. Other terms used in this description are also defined.

The general architecture of the GPRS protocol layers has already been described above with reference to Figure 1. The present invention is primarily concerned with the upper layers of this architecture and as such the RLC, LLC, and layer 3 entities are shown separately in Figure 2. The layer 3 entities shown are signalling, SMS, and the packet data protocols IP and X.25 (both PTPs), PTM-G, and PTM-M.

The LLC layer formats data into LLC frames each of which contains a data link connection identifier (DLCI) which in turn contains a SAPI (with a value of from 0 to 15). As already explained above, the SAPI identifies the service access point on the network side and the user side of the LLC layer. SAPIs have a predefined value, known to the network and the listening MSs (typically the SAPIs are prestored in a memory of the MS), so that the LLC layer can 'route' received transmissions appropriately even in the IDLE state. Consider for example the case where a transmission is received by a MS.

The LLC layer selects the appropriate service access point, i.e. signalling, SMS, or SNDTCP, in dependence upon the SAPI.

In the case that the SAPI identifies the SNDTCP, the data is then processed in accordance with the SNDTCP. Each SNDTCP data unit contains in turn an NSAPI which identifies the particular PDP being used, i.e. IP, X.25, PTM-G, or PTM-M. NSAPIs can have a value from 0 to 15, represented by a four bit binary code. Unlike the SAPIs which are permanently allocated, the NSAPIs for IP, X.25, and PTM-G (and possibly up to 11 other PDPs) are allocated dynamically by the network. MSs are notified of the dynamic allocation by signalling messages. However, these are only received by MSs which are in either the STANDBY or READY state.

One NSAPI is permanently assigned to the PTM-M PDP and this is known to the MS and to the network. As with the SAPIs, the PTM-M NSAPI is prestored in a memory of the MS. In the event that a MS is the IDLE state, and a received SNDTCP unit is routed to the SNDTCP from the LLC layer, the NSAPI of the unit is read to determine if it corresponds to the PTM-M NSAPI. If so, then the SNDTCP processes the unit accordingly and the PTM-M PDP is applied. If the NSAPI does not correspond to PTM-M NSAPI, then no further processing is carried out because the PDP used cannot be identified.

Figure 4 illustrates a modification to the protocol architecture show in Figure 3. This relies upon PTM-M transmissions not being routed through the SNDTCP layer. Rather, these transmissions are routed to the PTM-M layer directly from the LLC layer. In this case, a PTM-M transmission can be identified by permanently allocating a SAPI to PTM-M transmissions.

BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
GGSN	Gateway GPRS Support Node
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HLR	Home Location Register
IP	Internet Protocol
L3M	Layer 3 Management
LLC	Logical Link Control
MAC	Medium Access Control
MS	Mobile Station
MSC	Mobile Switching Centre
NSAPI	Network Service Access Point Identifier
PC/PDA	Personal Computer/Personal Data Assistant
PDP	Packet Data Protocol
PDU	Packet Data Unit
PSTN	Public-Switched Telephone Network
PTM-G	Point-To-Multipoint Group
PTM-M	Point-To-Multipoint Multicast
PTP	Point-To-Point
RLC	Radio Link Control
SAPI	Service Access Point Identifier
SGSN	Serving GPRS Support Node
SMS	Short Message Service
SNDCP	Subnetwork Dependent Convergence Protocol
SS7	Signalling System number 7
TCP/IP	Transmission Control Protocol/Internet Protocol
TDMA	Time Division Multiplexed Access
Um	Mobile Station to Network interface
UMTS	Universal Mobile Telecommunications Service
X.25	network layer protocol specification

## Claims

1. A method of operating a mobile communication system supporting radio data transmission between a mobile station (MS) and a network in a number of different packet data protocols (PDPs) including a point-to-multipoint-multicast (PTM-M) protocol, where the protocol is identified by a protocol identifier transmitted between the network and the mobile station, the method comprising permanently allocating a unique protocol identifier to PTM-M transmissions and dynamically allocating other identifiers to other protocols.
2. A method according to claim 1, wherein the method forms part of the General Packet Radio Service (GPRS).
3. A method according to claim 2, wherein data is formatted for transmission according to a subnetwork dependent convergence protocol (SND CP) which formats data in one of a plurality of different packet data protocols (PDP) for transmission via the system and *vice versa* for received data, the SND CP processing data in SND CP units, each of which contains a network service access point identifier (NSAPI) which identifies the PDP in use to the SND CP and the NSAPIs providing said protocol identifiers.
4. A method according to claim 2, wherein data for transmission and reception is formatted by a logical link control (LLC) layer below an SND CP layer, LLC formatting including the use of a service access point identifier (SAPI) to identify the service access point on the network side and on the user side of the LLC layer and the SAPIs providing said protocol identifiers.
5. Apparatus arranged to carry out the method of any one of claims 1 to 4.
6. A mobile communication device arranged to support the method of any one of claim 1 to 4, the device comprising a memory in which is stored the permanently allocated PTM-M protocol identifier, and signal processing means for determining

when a transmission from the network contains said PTM-M protocol identifier and for consequently receiving and processing said transmission.



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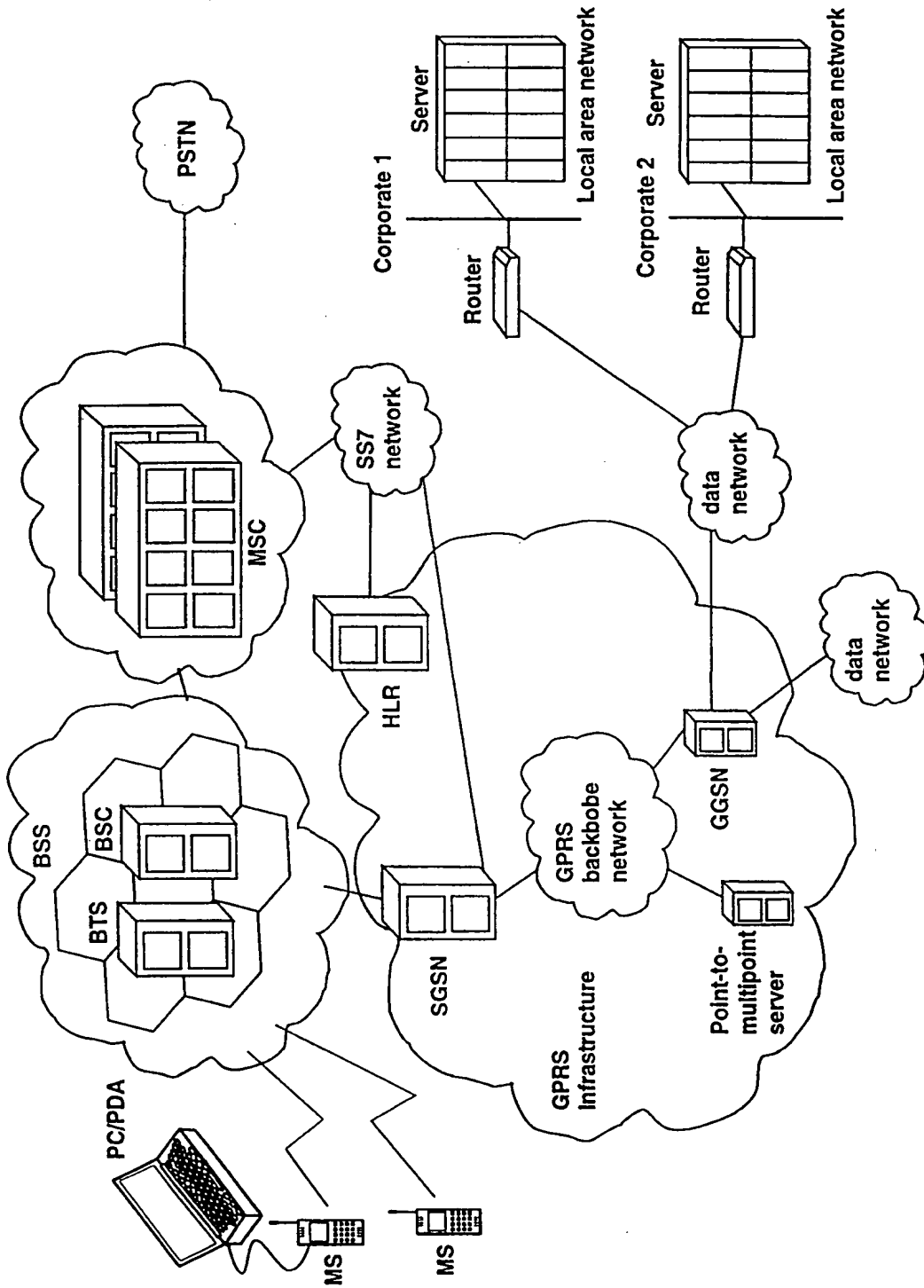
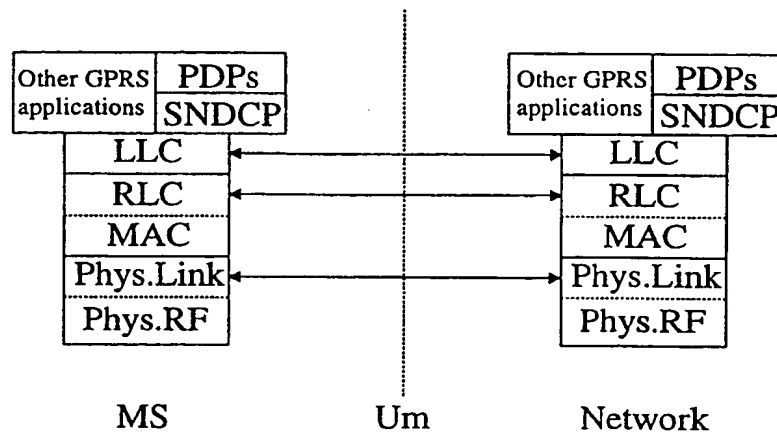
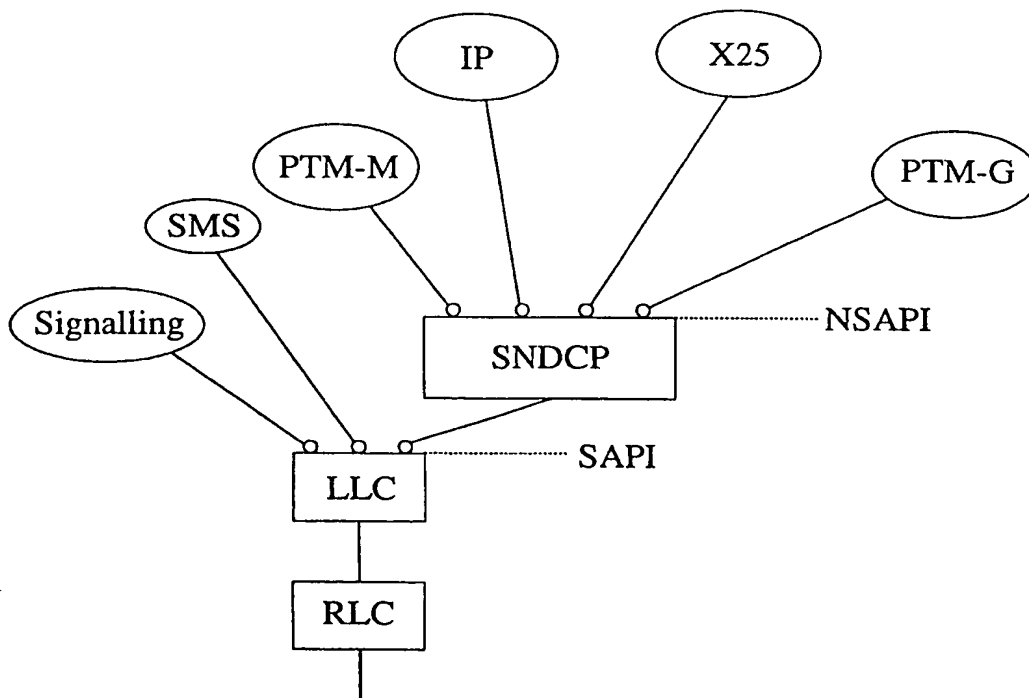
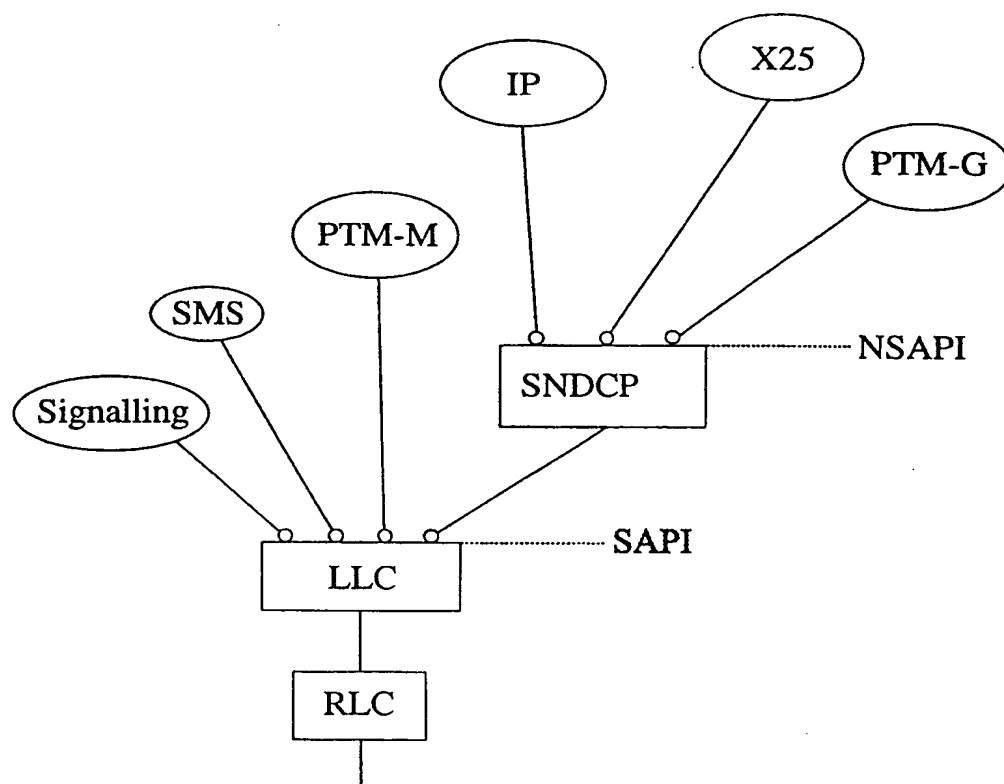


Figure 2

2/3

Figure 1Figure 3

3/3

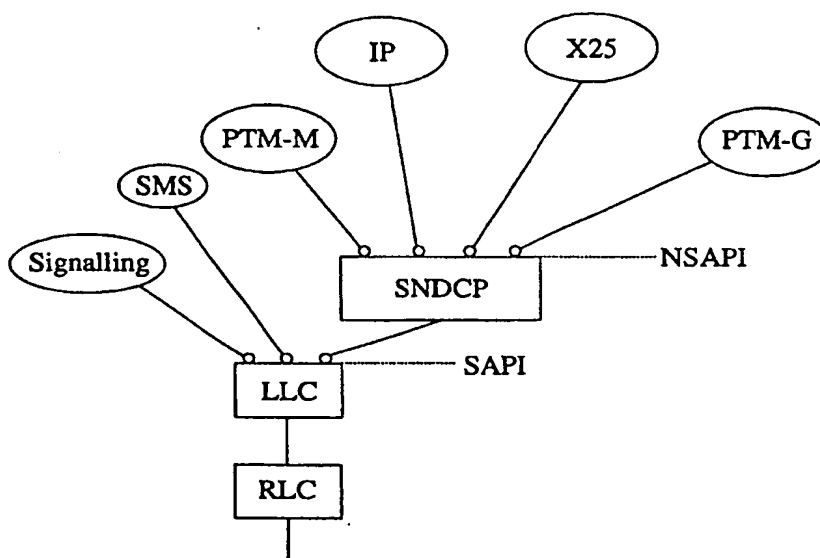
Figure 4



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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 98/00511

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/20

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	WO 9825422 A1 (NOKIA TELECOMMUNICATIONS OY), 11 June 1998 (11.06.98) --	1-6
A	WO 9621984 A2 (NOKIA TELECOMMUNICATIONS OY), 18 July 1996 (18.07.96) --	1-6
A,E	WO 9853576 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 26 November 1998 (26.11.98) -- -----	1-6

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 ☒ See patent family annex.

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Information on patent family members

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